

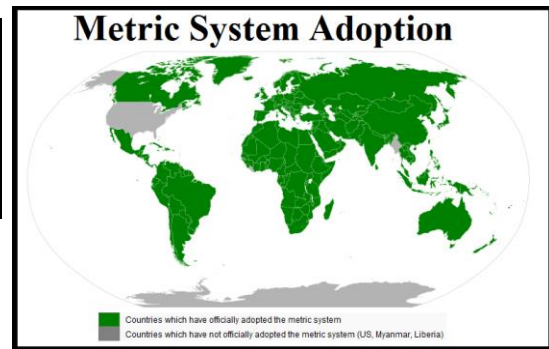
06 Decimal metric system

US CUSTOMARY UNITS AND METRIC SYSTEM EQUIVALENCE

Most countries have officially adopted the metric system. The US is almost the only one that uses the customary units.

LENGTH

Unit	Divisions	MS Equivalent
1 inch (in)		25.4 mm
1 foot (ft)	12 in	30.48 cm
1 yard (yd)	3 ft	91.44 cm
1 mile (mi)	5280 ft or 1760 yd	1.609344 km

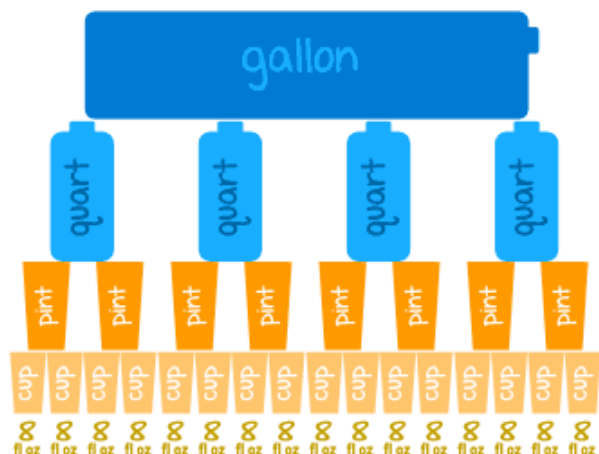


CAPACITY

Unit	Divisions	MS Equivalent
1 fluid ounce (fl oz)		29.57 ml
1 cup (cp)	8 fl oz	236.6 ml
1 pint (pt)	2 cp	473.2 ml
1 quart (qt)	2 pt	0.95 l
1 gallon (gal)	4 qt	3.79 l

WEIGHT

Unit	Divisions	MS equivalent
1 ounce (oz)		28.35 g
1 pound (lb)	16 oz	453.6 g
1 ton (ton)	2000 lb	907.2 kg



WEBSITES

It is very useful to watch these videos about the US customary system.

Try to watch them and give me your opinion.

Units of length: <http://goo.gl/Fi9TFC>

Units of weight: <http://goo.gl/skpT7A>

Units of volume: <http://goo.gl/zj4dB6>

POWERS OF TEN

Choose an object from the website: 'The Scale of the Universe 2' whose link is:

<http://htwins.net/scale2/> and write its size as a power of ten, draw it, and write the description you can get from the website.

1. DECIMAL METRIC SYSTEM

You use this system to measure. We call it decimal because its base is ten.

Example:

10 metres are a decametre, 100 metres is a hectometre and so on.

MAGNITUDE

It is a property that you can measure. E.g.: Length, weight, area...

QUANTITY

It is a portion of a magnitude. E.g.: 5 m, 8 Kg, 25 m².

UNIT

A unit is a quantity of a magnitude that we take as a reference.

For example; the metre, the second, the gram...

MEASUREMENT

It is the number that results of comparing a quantity with a unit.

For example; this table is 60 cm in length. This book is 1 Kg heavy.

We use the following prefixes to design the most important multiples and submultiples of the unit.

...	k	h	da	u	d	c	m	...
	kilo	hecto	deca	unit	deci	centi	mili	

Name	The number	Prefix	Symbol
million	1000000	mega	M
thousand	1000	kilo	k
hundred	100	hecto	h
ten	10	deca	da
unit	1		
tenth	0.1	deci	d
hundredth	0.01	centi	c
thousandth	0.001	mili	m
millionth	0.000001	micro	μ

2. UNITS OF LENGTH

LENGTH (m)

The metre is the principal length unit.

km kilometre	hm hectometre	dam decametre	m metre	dm decimetre	cm centimetre	mm millimetre
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You have to multiply by ten to convert one unit into another smaller.

Therefore, you have to divide into ten to convert one unit into another larger.

ASTRONOMICAL UNIT

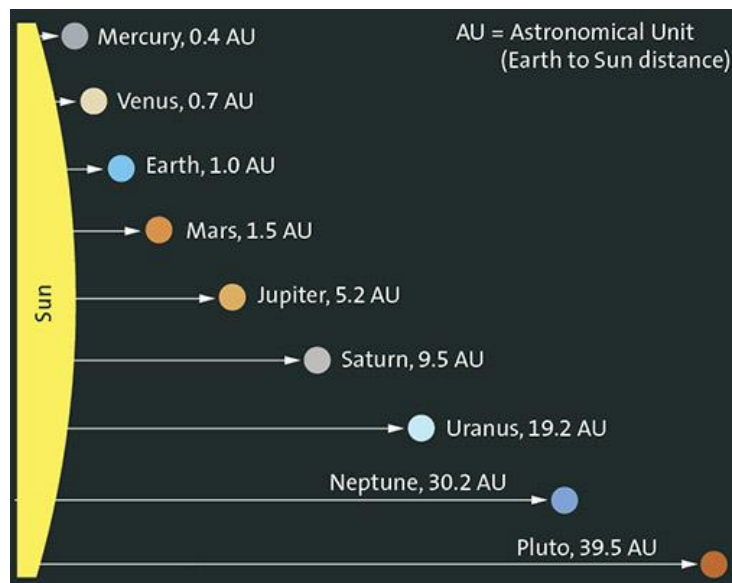
It is the distance from the Earth to the Sun. $1 \text{ A.U.} = 149\,600\,000 \text{ km} \approx 1.5 \cdot 10^8 \text{ km}$.

We use the astronomical unit (A.U.) to write the distances between objects in our Solar System.

We use the light year for measuring distances between stars and galaxies.

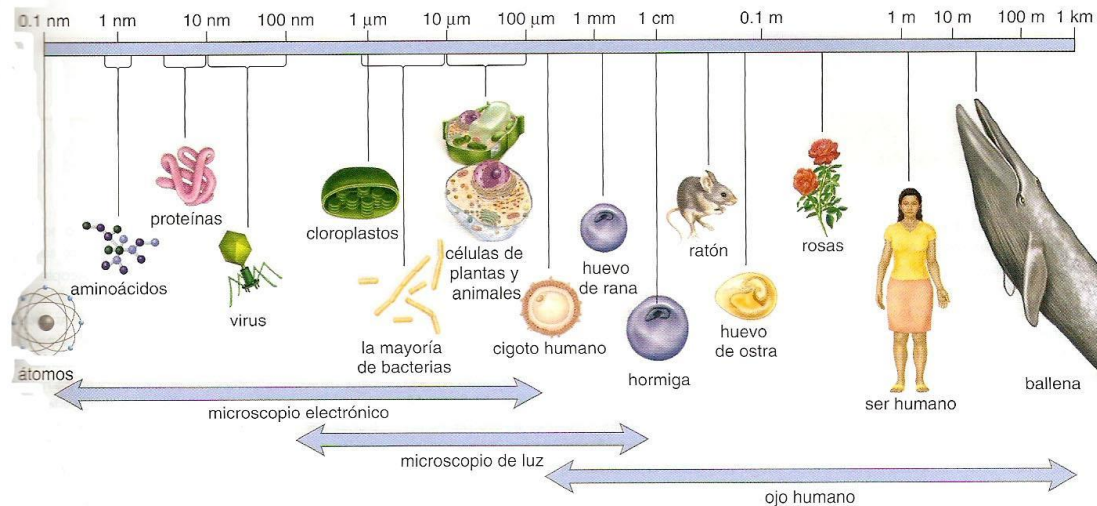
The light-year is the distance light travels in one year.

$1 \text{ l.y.} = 9\,461\,1012 \text{ km}$



MICROSCOPIC UNITS

We use the micron to measure very small lengths like a virus or bacteria.
The micron is one millionth of a metre. That is one thousandth of a millimetre.
For instance, the flu virus is 0.1μ long.



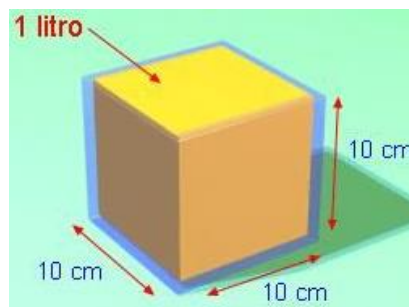
3. UNITS OF MASS AND CAPACITY

Mass

The gram is the unit of mass. A gram is the mass of a cm^3 –cubic centimetre- of water in some specific condition

Capacity

A litre is a unit for capacity.
1 litre is the volume of a 1 dm^3 .



4. UNITS OF AREA

AREA (m^2)

The principal unit of area is the square metre.

...	km^2 square kilometre	hm^2 square hectometre	dam^2 square decametre	m^2 square metre	dm^2 square decimetre	cm^2 square centimetre	mm^2 square millimetre
Crop measurement		ha=hectare	a=area	ca=centiare			

You have to multiply by one hundred to convert one unit into another smaller unit.
Therefore, you have to divide into one hundred to convert one unit into another larger unit.

Crop and land units

The principal unit to measure crops and land is the area.
The area is the measurement of a square whose side is 10 m.
Therefore, 1 a = 100 m².
It is more common to use the hectare to measure grounds.
1 ha = 100 a = 10000 m² = 1 hm².

5. UNITS OF VOLUME

VOLUME (m³) AND CAPACITY

Volume measurement	km ³ Cubic kilometre	hm ³ cubic hectometre	dam ³ cubic decametre	m ³ cubic metre	dm ³ cubic decimetre	cm ³ cubic centimetre	mm ³ cubic millimetre
Capacity measures equivalence				kl	l=litre	ml	

You have to multiply by one thousand to convert one unit into another smaller unit.
Thus, you have to divide into one thousand to convert one unit into another larger unit.

THEORY LESSON

Decimal metric system

The system we use to measure. We call it decimal because its base is ten.

Magnitude

It is a property that you can measure.

Quantity

It is a portion of a magnitude.

Unit

A unit is a quantity we take as reference.

Measurement

It is the result of comparing a quantity with a unit.

Astronomical unit

It is the distance from the Earth to the Sun. $1 \text{ A.U.} = 149\,600\,000 \text{ km} \cong 1.5 \cdot 10^8 \text{ km}$.

Light-year

The light-year is the distance light travels in one year. $1 \text{ l.y.} = 9'461'1012 \text{ km}$.

Micron

The micron is one millionth of a metre.

Gram

A gram is the mass of a cm^3 –cubic centimetre- of water.

Litre

1 litre is the volume of a 1 dm^3 .

Area

The area is the measurement of a square whose side is 10 m. Therefore, $1 \text{ a} = 100 \text{ m}^2$.

Hectare

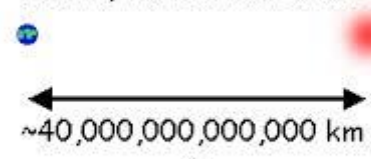
It is one hundredth areas. $1 \text{ ha} = 100 \text{ a} = 10000 \text{ m}^2 = 1 \text{ hm}^2$.

EXERCISES AND PROBLEMS

1. Units of length

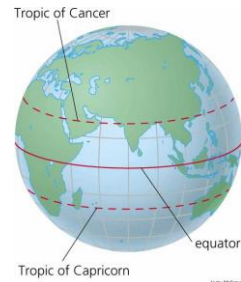
1. From a bobbin, which is 2'45 km long, how many 3'5 cm strips long do we approximately get?
2. We have a rope 2'415 km long and we cut the rope into portions of 35 mm long. How many parts do we approximately get?
3. A staircase is 13'4 metres high and it has 24 steps. How many centimetres tall is each step?
4. Light travels 300000 km in a second. How many km does it travel in one year? Write the result as a power of ten.
5. The closest star to the Earth is 4.24 light-years from here. Calculate the distance in kilometres writing the result as a power of 10.
A light year is $9'461 \cdot 10^{12}$ km

Distance from Earth to Proxima Centauri, the next nearest star



~40,000,000,000,000 km
or
~4.24 light-years

6. We know that the perimeter of the Equator is $4 \cdot 10^4$ Km. How many times would a beam of light travel around the Equator in a second?
A light year is $9'461 \cdot 10^{12}$ km



7. The Milky Way has $1'2 \cdot 10^{11}$ stars. Write the number of star in a decimal form.



8. Light takes eight minutes to travel from the Sun to Earth. How many kilometres does it travel in this trip? Put the result as a power of ten.



2. Units of mass and capacity

9. A pipe leaks 2 litres of water per minute. How many litres of water does it lose a day?

3. Units of area

10. Change into square metres the following quantities:
2 hm²; 3 dm²; 50 dam²; 0'02 km²
11. Complete the equality:
a) 3'7 ha = m²; b) 1250 m² = ha; c) 4578 ha = km².

- 12.** Complete the equalities to get an equality:
a) $23'76 \text{ ha} = \text{ m}^2$; b) $0'02 \text{ km}^2 = \text{ ha}$; c) $357,9 \text{ ha} = \text{ km}^2$.
- 13.** Complete the equalities:
a) $5 \text{ ha} = \text{ m}^2$; b) $1000 \text{ m}^2 = \text{ ha}$; c) $2789,6 \text{ ha} = \text{ km}^2$.
- 14.** Complete the equalities:
a. $17,223 \text{ kg} + 430 \text{ g} + 98000 \text{ cg} = \text{ kg}$.
b. $17.223 \text{ kg} + 430.5 \text{ g} + 98026 \text{ cg} = \text{ kg}$
- 15.** We collect 5 kg of corn per m^2 from a crop of $234'48$ hectares. How many tons does it produce?
- 16.** A field is $12'25 \text{ ha}$. If a vine needs $3'2 \text{ m}^2$, how many vines fit in the vineyard?
- 17.** A field has a surface of $7'85 \text{ ha}$ and is sowed with tomatoes. We collect two and half kg of tomatoes per m^2 . How many kgs of tomatoes do we get in total?
- 18.** The area of a field is $12'25 \text{ ha}$. If each vine needs $2'5$ square metres. How many vines fit on the vineyard?
- 19.** A field is 2.6 ha in surface area and we plant vines. If we collect on average 2.5 l of wine per metre squared, how many litres of wine would we have in total?

4. Units of volume

- 20.** Find the missing value in the following equalities:
a) $3267 \text{ m}^2 = \text{ dam}^2$; b) $325 \text{ dm} = \text{ km}$; c) $346 \text{ mm}^3 = \text{ dm}^3$; d) $58 \text{ dam}^2 = \text{ cm}^2$.
- 21.** Find the missing value in the following equalities:
a) $32'67 \text{ m}^2 = \text{ dam}^2$; b) $325 \text{ km} = \text{ dm}$; c) $346 \text{ dam} = \text{ dm}$; d) $58 \text{ dam}^3 = \text{ cm}^3$.
- 22.** Find the missing value in the following equalities:
a) $326.7 \text{ m}^2 = \text{ dam}^2$; b) $325.7 \text{ dm} = \text{ km}$; c) $346.5 \text{ mm}^3 = \text{ dm}^3$;
d) $5.86 \text{ dam}^2 = \text{ cm}^2$
- 23.** Find the missing value in the following equalities:
a) $26.7 \text{ hm}^2 = \text{ m}^2$; b) $25.72 \text{ hm} = \text{ km}$; c) $3146.5 \text{ mm}^3 = \text{ liters}$;
d) $5.86 \text{ ha} = \text{ hm}^2$
- 24.** Change the following quantities:
a. $125 \text{ cm} = \text{ dam}$.
b. $2 \text{ hg} = \text{ g}$.
c. $20 \text{ l (litros)} = \text{ cm}^3$.
- 25.** Convert the following quantities:
a. $12 \text{ mm} = \text{ cm}$.
c. $0,2 \text{ kl} = \text{ cl}$.
c. $1 \text{ l (liter)} = \text{ cm}^3$.
- 26.** Complete the equalities:
a. $2,4 \text{ m}^3 + 93 \text{ dm}^3 + 10 \text{ l} + 452 \text{ cl} = \text{ dm}^3$
- 27.** A tap gets $2'5$ litres of water per minute. How long does it take to fill a pool of $24'5 \text{ m}^3$ of water?
- 28.** We take in 500 cm^3 of air per breath. We do that 12 times per minute. How many litres of air go in our lungs a year? Express the result as power of ten.
- 29.** How many litres of water is $1\text{mm}/\text{m}^2$ of rain?

- 30.** It rains 2'7 litres per m^2 . What volume of water does a dam, 235'7 ha in surface, get?
- 31.** It rains 0'5 litres of water per m^2 . What volume does a dam of 5200 m^2 get?
- 32.** There are 78000 people in a crowd. To share water the council use a tank truck with 327 m^3 of water. How many litres could each person receive on average?
- 33.** A village of 35000 people suffers a water cut. In order to give water to everybody the council carry to the main square a tank-truck with 235 m^3 of water to share among the neighbours. What quantity of water could each person receive on average?
- 34.** For a pipe supplying seven litres of water per minute, how long does it take to fill a tank of 2'4 cubic metres of water?
- 35.** We have a tank with 79845 litres of water. We distribute the tank in bottles of 75 cm^3 . How many bottles do we get approximately?